Information Operations: Assessing the Human Element in System Performance

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Today the United States faces new enemies not foreseen when its operational systems were in research and development years ago. We face new challenges of developing and implementing systems more quickly, of making those systems more precise and effective, and of performing the tests and evaluations to validate performance expectations. Along with these challenges comes the overwhelming necessity for information superiority. As explained in new draft Air Force Doctrine Document 2-5, "The aim of information superiority is to have greater situational awareness and control over the adversary. Effective use of information operations (IO) leads to information superiority." Future doctrine indicates IO is the linchpin holding our air and space operations together. And the critical measure of our success in IO will be the success of the decisions our commanders make.

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What is IO? Air Force doctrine-in-development goes beyond a delineation of information warfare (IW) ("attack" and "defend") and information-in-warfare ("gain" and "exploit") of the past doctrine. Emphasis is now on network warfare operations, influence operations, electronic warfare operations and integrated control enablers, such as predictive battlespace awareness and intelligence, surveillance and reconnaissance. Joint doctrine is evolving as well, and there is a new emphasis from the Secretary of Defense on streamlining the services' IO doctrine. But no matter how you slice it, IO has a uniquely human bottom line. A person, and that person's gray matter, are required for information to have any significance in decision-making. Critical information can surely be passed from machine to machine to hasten its dissemination. But when was the last time a machine was held accountable for a major mishap? It is always a human who either failed to understand, act or control. More often than not, it is the human who is able to create success in the face of the fog of war and in against-all-odds types of situations.

Today, I see reflections of a growing awareness across the Department of Defense. As systems become more complex, we have an ever-greater mandate to consider the human element in how we will operate and control our new technological marvels. Blaming human error for failures is becoming recognizably lame. A broader understanding is taking shape, however, that we have to design within systems a capability to be controlled; to actually think about how to provide people with insight into an appropriately calibrated trust of the automation. For the better part of 50 years, government laboratories have been dedicated to research in this area, which in turn, has led to methods for test and evaluation of the human element in system performance.

The Air Force Research Laboratory's (AFRL's) Human Effectiveness Directorate is conducting research focused on integrating the human element into complex systems design. Because information operations has particularly human attributes and implications, we have designated IO as a major emphasis area, and we have designed and implemented a staff office to tune and sharpen the IO programs to meet critical future requirements. As our scientists

and engineers have traveled the world interviewing Air Force people in IW flights and have engaged with IO Center warfighters in San Antonio, Texas, we have catalogued a broad range of needs for applying human factors research and conducting the right evaluations of human performance. Clearly, IO is an emerging and "forming" area of warfare, and much work still needs to be done.

One area being addressed is visualization, or how to present information to the IW operator. A huge problem with IW is in the ability to understand what effect an action has—battle damage assessment. This is known as the "smoking hole" problem in IW—the lack of a conventional weapon's smoking hole to determine effects. To address this problem, we are researching and developing an Information Warfare Combat Assessment Tool (IWCAT) to monitor and evaluate the effectiveness of IW actions. The effort is based on extensive interviews with IW flights to understand their processes, decision requirements and system-level constraints.

If we do our job right, this tool will correlate IW missions with commanders' objectives and offer rapid situational awareness of the missions and their effectiveness. Tool operators will be able to see the current status and history of each indicator, make assessments and view individual intelligence reports. In effect, it will provide what our customers are calling an IW campaign dashboard, enabling visualization of the overall effect that IO is bringing to the fight, particularly the connection between the mission and the objective. The IW flights have told us that it is important to them to manage the time lags in IW missions and to see when, not just where, operations will occur. They also need to deconflict and synchronize IW missions with one another. We are attempting to provide these capabilities. Evaluations of just how well this system accomplishes these goals will be critical to the program. It is just one of several areas we are researching toward supporting IW operators in performing their mission.

On another note, a role the Human Effectiveness Directorate would like to play more of in the future is the "honest broker" in major system-of-systems demonstrations and exercises. Included is a role of "expert advisor" to the test and evaluation community. Centers and users we have talked to need teams of people who possess tools for measuring situational awareness and decision effectiveness. This is particularly significant as new paradigms for publish/subscribe and other aspects of network-centric warfare are spirally instantiated and evaluated. Our people on the sharp end of the spear are putting their lives on the line to do the mission. We who guide science and technology development have a responsibility to look beyond seemingly revolutionary technology.

Too often, we become enamored with technology, bandwidths, architectures and tools at the expense of losing sight of how a system's interface looks, feels and helps a human do the mission. In human effectiveness, we have been developing and refining methods for embedded measurements of decision effectiveness and situational awareness. We are developing methods and processes for projecting and teasing out future systems requirements. We would like to deepen our support to the IO community by playing an independent assessor role for government customers who are themselves trying to make sense of the alphabet soup of architectures and tools being developed and evaluated.

As we look to the future, we will continue to meet the demands and the necessity for information superiority. Faced with increasingly automated systems, we see a parallel increase in the number of catastrophic incidents involving humans who do not understand where their automation is going or what it is doing. We all have faced frustration at simply trying to move Microsoft's friendly paper clip out of the way of our ongoing work. And Microsoft Word is not really all that complex. Imagine, for instance, trying to facilitate a combat search and rescue mission while dealing with multiple non-integrated software "tools" whose designers had failed to consider the time pressures or environmental constraints under which their systems would be used.

The human link is both the weakest and the strongest—it is often unreliable and exploitable—but it also offers the greatest strength and resilience, capable of overcoming shortfalls of ill-designed hardware, software and weapon systems. We need to make sure we invest in this link with advocacy and processes to support our people, who are—without a doubt—the greatest treasure we have. ❑

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